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UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No. RCA89605
Total Pages in this Submission

TO THE ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

APPARATUS AND METHOD FOR REDUCING THE VISUAL EFFECTS OF ARTIFACTS PRESENT IN A LINE SCANNED VIDEO DISPLAY

and invented by:

KEEN, Ronald Thomas

If a CONTINUATION APPLICATION, *check appropriate box and supply the requisite information:*

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

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Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below
2. ☒ Specification having **Eight (8)** pages and including the following:
   - a. ☒ Descriptive Title of the Invention
   - b. ☒ Cross References to Related Applications *(if applicable)*
   - c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*
   - d. ☐ Reference to Microfiche Appendix *(if applicable)*
   - e. ☒ Background of the Invention
   - f. ☒ Brief Summary of the Invention
   - g. ☐ Brief Description of the Drawings *(if drawings filed)*
   - h. ☒ Detailed Description
   - i. ☒ Claim(s) as Classified Below
   - j. ☒ Abstract of the Disclosure

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Application Elements (Continued)

3. ☐ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
   a. ☐ Formal Number of Sheets _____
   b. ☐ Informal Number of Sheets _____
4. ☐ Oath or Declaration
   a. ☐ Newly executed *(original or copy)* ☐ Unexecuted
   b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
   c. ☐ With Power of Attorney ☐ Without Power of Attorney
   d. ☐ *DELETION OF INVENTOR(S)*
   Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. 1.63(d)(2) and 1.33(b).
5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
   The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ Computer Program in Microfiche *(Appendix)*
7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
   a. ☐ Paper Copy
   b. ☐ Computer Readable Copy *(identical to computer copy)*
   c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☐ Assignment Papers *(cover sheet & document(s))*
9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*
10. ☐ English Translation Document *(if applicable)*
11. ☒ Information Disclosure Statement/PTO-1449 ☒ Copies of IDS Citations
12. ☐ Preliminary Amendment
13. ☒ Acknowledgment postcard
14. ☒ Certificate of Mailing
    ☐ First Class ☒ Express Mail *(Specify Label No.):* **EL533625294US**

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Accompanying Application Parts (Continued)

15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*

16. ☐ Additional Enclosures *(please identify below):*

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra		Rate	Fee
Total Claims	24	- 20 =	4	x	$18.00	$72.00
Indep. Claims	2	- 3 =	0	x	$78.00	$0.00
Multiple Dependent Claims (check if applicable) ☐						$0.00
					BASIC FEE	$760.00
OTHER FEE *(specify purpose)*						$0.00
					TOTAL FILING FEE	$832.00

☐ A check in the amount of to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **07-0832** as described below. A duplicate copy of this sheet is enclosed.

- ☒ Charge the amount of **$832.00** as filing fee.
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- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Signature

Dated: 12/16/99

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cc:

EXP. MAIL EL533625294US

APPARATUS AND METHOD FOR REDUCING THE VISUAL EFFECTS OF ARTIFACTS PRESENT IN A LINE SCANNED VIDEO DISPLAY

FIELD OF THE INVENTION

The present invention relates to the processing of video signals, and more particularly, to the amelioration of artifacts introduced by periodic signals leaking or introduced into the luminance channel of a color television receiver.

BACKGROUND

As a review, for an NTSC color television signal, the spectral energy of the luminance (Y) signal is essentially centered at harmonics of the line scanning frequency nf_h where n is an integer. Thus, a luminance signal typically has frequency components of $1f_h$, $2f_h$, $3f_h$, $4f_h$, etc. The chrominance (C) signal spectral energy peaks occur at odd harmonics of one half the line scanning frequency, i.e., $(n+1/2)f_h$ where n is an integer. Thus, the Y and C energy spectra are frequency interleaved.

U.S. Patent No. 4,607,286 of Weimer concerns the electrostatic coupling of forward clocking signals in a CCD imager to the underlying bulk semiconductor substrate which introduces transient disturbances leaving visible artifacts in television pictures reconstructed from the video signals generated from the CCD imager. An additional clocked delay places the disturbances into the line retrace interval and the disturbances are removed from the video signals by line retrace blanking.

U.S Patent Nos. 4,291,330 and 4,134,126, both of Hirai, teach that in a color video recorder, an interfering or cross-talk signal having a frequency $(n+1/2)f_h$ will have a frequency interleaved relationship to the frequency of the main luminance components with the result that the cross-talk signal will be phase inverted in successive horizontal lines of the video signals, and that since there is a high correlation between the reproduced luminance components in successive horizontal line intervals, the cross-talk signals will not appear as a conspicuous noise or beat on an image reproduced on a cathode ray tube but will be largely visually canceled.

U.S. Patent No. 4,003,077 of Hickock concerns a color video recorder wherein the chrominance information is frequency converted before

recording to a frequency to render, upon display, an artifact pattern of one line of the picture frame being 180 degrees out of phase with the artifact pattern of an adjacent line, so that the resultant artifact pattern, although present, seemingly disappears due to the integrating effect of the eye of the viewer.

SUMMARY OF THE INVENTION

During production of a video processing integrated circuit having, inter alia, a graphics generator, a video processor, and a spread spectrum clock, it was discovered that the signal for FM modulating the carrier signal of the clock, due to internal signal leakage within the chip, caused an artifact to appear when viewed on a line scanned video display, e.g., a cathode ray tube. Rather than undertake the extensive and expensive redesign of the integrated circuit to eliminate the artifact, since the frequency of the interfering signal was selectable, it was decided to select the frequency of the interfering signal so that the frequency would be an odd harmonic of one half the horizontal line scan frequency. By making the particular selection of frequency to be an odd harmonic of one half of the horizontal line scan frequency, adjacent scan lines of the artifact are 180 degrees out of phase with each other. Thus, the artifact is rendered largely visually canceled when viewed on a line scanned display, due to the integrating characteristics of the eye of the viewer, even though the artifact is still there.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The exemplary embodiment of the present invention concerns an integrated circuit number W49C31-20A which is a low-power CMOS monolithic chip made by the IC Works of San Jose, California, USA, and includes a graphics processor, a video processor and a spread spectrum clock. The present invention concerns a video processor wherein a signal having a frequency within the video passband "leaks" into the video processor, and in the exemplary embodiment, the leaked signal, which produces an artifact on a video display, is derived from the modulation signal of a spread spectrum clock. It should be noted however, for purposes of the present invention, that the leaked artifact producing signal can be derived from any source, and leaked or introduced into any common video processor. Thus, the construction and circuitry of the exemplary chip including the exemplary video processor, the exemplary spread spectrum clock, and the

exemplary generation of the modulation signal for the spread spectrum clock, all form no part of the present invention.

It is believed that the artifact creating signal leaks into the video path by electrostatic and/or capacitive coupling either between sections, or through electrostatic and/or capacitive coupling by the respective structures with the semiconductor substrate material. The artifact creating signal in the exemplary embodiment, is the modulation signal of a spread spectrum clock which falls within the video passband of up to 10 MHz. The carrier signal for the clock is outside of the video passband, i.e., 85 MHz, but if it fell within the video passband, or any other frequency selectable, periodic, artifact producing signal fell within the video passband, the present invention would be equally applicable in order to "hide" the produced artifact.

More particularly, during production of the monolithic integrated circuit it was discovered that the signal for FM modulating the carrier signal of the clock, due to internal signal leakage within the chip, caused an artifact to appear when viewed on a line scanned video display such as a cathode ray tube. Rather than undertake the extensive and expensive redesign of the integrated circuit to eliminate the artifact, it was decided to take an alternate approach.

The frequency of the interfering signal was selectable. Thus, it was decided that since the frequency was selectable, to select the frequency of the interfering signal so that the signal frequency would be an odd harmonic of one half the horizontal line scan frequency commonly referred to as f_h, which for an NTSC signal is 15,734.26573 Hz. Thus, the particular selection of frequency of the interfering modulation signal of the spread spectrum clock was 39.336 kHz (2.5 multiplied by f_h), which can be rounded up or down to the nearest integral kHz of 39 kHz or 40 kHz.

For such a harmonic relationship to f_h, the artifact displayed on adjacent scan lines on the line scanned display are 180 degrees out of phase with each other. Thus, the artifact is rendered largely visually canceled when viewed due to the integrating characteristics of the eye of the viewer, even though the artifact is still there. This is true for both interlaced and progressive scan frames except that one line at the top or bottom of each interlace field will not appear to be canceled. The line having the visually unreduced artifact can be placed in the

vertical overscan portion of picture, and thus will be hidden, or can be hidden by vertical blanking.

Further, the interfering signal is also frequency interleaved with the luminance signal, as discussed above in the background section. The frequency interleaving further reduces artifacts.

The present invention is applicable to the choice of the frequency of a periodic signal within the video passband, leaked or intentionally introduced by whatever means, into a video signal path of whatever means, which causes an artifact to appear when viewed on a line scanned display. Such an intentional introduction of an artifact producing signal into the video path can be, e.g., an information encoded signal. It should be noted that the artifact producing signal of the exemplary embodiment is an information encoded signal but the introduction into the video signal path was unintentional.

WHAT IS CLAIMED:

1. In a television receiver having a line scanned video display, a method for reducing the visual effects of an artifact in a line scan portion of the video signal display, the artifact being attributable to a periodic signal within the video pass band coupled to a video processing path of a video circuit, the line scan having a frequency of f_h, comprising:

selecting the frequency of the periodic signal, and

predetermining the frequency of the periodic signal to be an odd harmonic of $f_h/2$.

2. The method of claim 1 wherein the periodic signal is a clock signal electrostatically/capacitively coupled to the video circuit.

3. The method of claim 2 wherein the electrostatically/capacitively coupled clock signal is an FM modulating signal of a spread spectrum clock.

4. The method of claim 2 wherein the electrostatically/capacitively coupled clock signal is a carrier signal of a spread spectrum clock.

5. The method of claim 1 wherein f_h is the NTSC standard horizontal scan frequency of 15,734.26573 Hz and the predetermined fundamental frequency of the periodic signal is approximately 39.336 kHz (2.5 multiplied by f_h).

6. The method of claim 5 wherein the predetermined fundamental frequency of the periodic signal is rounded up or rounded down to an integral number.

7. The method of claim 1 wherein the predetermined fundamental frequency of the periodic signal is one of rounded up and rounded down to an integral number.

8. The method of claim 2 wherein the video circuit, and the electrostatically/capacitively coupled periodic signal are included within an integrated circuit having an underlying substrate of semiconductor material.

9. The method of claim 8 wherein the electrostatically/capacitively coupling is via respective capacitances coupled to the underlying substrate.

10. The method of claim 1 wherein the periodic signal is electrostatically/capacitively coupled to the video circuit.

11. The method of claim 10 wherein the video circuit, and the electrostatically/capacitively coupled periodic signal are included within a

monolithic integrated circuit having an underlying substrate of semiconductor material.

12. The method of claim 11 wherein the electrostatic coupling is via capacitances to one of the underlying substrate and between component parts of the monolithic integrated circuit.

13. In a television receiver having a line scanned video display, apparatus for reducing the visual effects of an artifact in a line scan portion of the video signal display, the artifact being attributable to a periodic signal within the video passband coupled to a video processing path of a video circuit, the line scan having a frequency of f_h, comprising:

means for selecting the frequency of the periodic signal, and

means for predetermining the frequency of the periodic signal to be an odd harmonic of $f_h/2$.

14. The apparatus of claim 13 wherein the periodic signal is a clock signal electrostatically/capacitively coupled to the video circuit.

15. The apparatus of claim 14 wherein the electrostatically/capacitively coupled clock signal is an FM modulating signal of a spread spectrum clock.

16. The apparatus of claim 14 wherein the electrostatically/capacitively coupled clock signal is a carrier signal of a spread spectrum clock.

17. The apparatus of claim 13 wherein f_h is the NTSC standard horizontal scan frequency of 15,734.26573 Hz and the predetermined fundamental frequency of the periodic signal is approximately 39.336 kHz (2.5 multiplied by f_h).

18. The apparatus of claim 17 wherein the predetermined fundamental frequency of the periodic signal is one of rounded up and rounded down to an integral number.

19. The apparatus of claim 13 wherein the predetermined fundamental frequency of the periodic signal is rounded up or rounded down to an integral number.

20. The apparatus of claim 14 wherein the video circuit, and the electrostatically/capacitively coupled periodic signal are included within an integrated circuit having an underlying substrate of semiconductor material.

21. The apparatus of claim 20 wherein the electrostatically/capacitively coupling is via respective capacitances coupled to the underlying substrate.

22. The apparatus of claim 13 wherein the periodic signal is electrostatically/capacitively coupled to the video circuit.

23. The apparatus of claim 22 wherein the video circuit, and the electrostatically/capacitively coupled periodic signal are included within a monolithic integrated circuit having an underlying substrate of semiconductor material.

24. The apparatus of claim 23 wherein the electrostatically/capacitively coupling is via capacitances to one of the underlying substrate and directly between component parts of the monolithic integrated circuit.

ABSTRACT

On a line scanned video display, the frequency of an artifact producing signal within the video passband is selected to be an odd harmonic of one half the horizontal line scan frequency so that adjacent scan lines of the artifact are 180 degrees out of phase with each other. Thus, the artifact is rendered largely visually canceled when viewed due to the integrating characteristics of the eye of the viewer, even though the artifact is still there.